

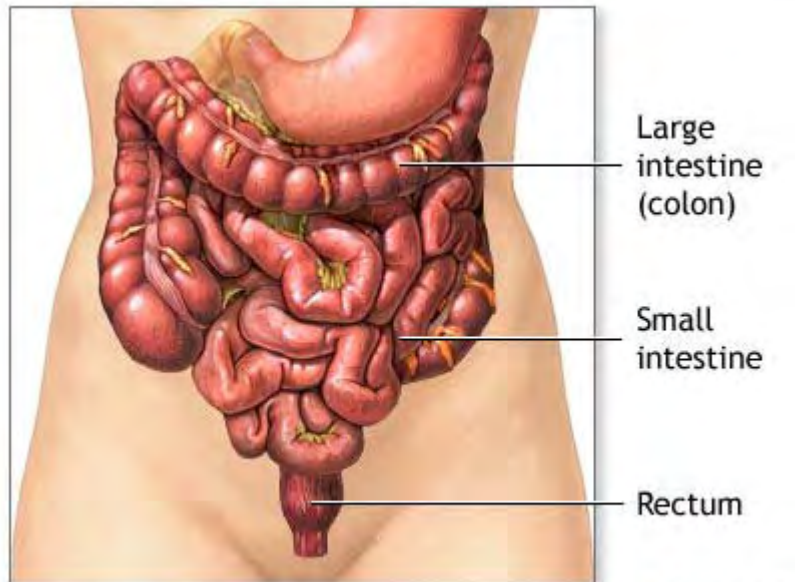


The Basics of Anaerobic Digestion

M. Charles Gould

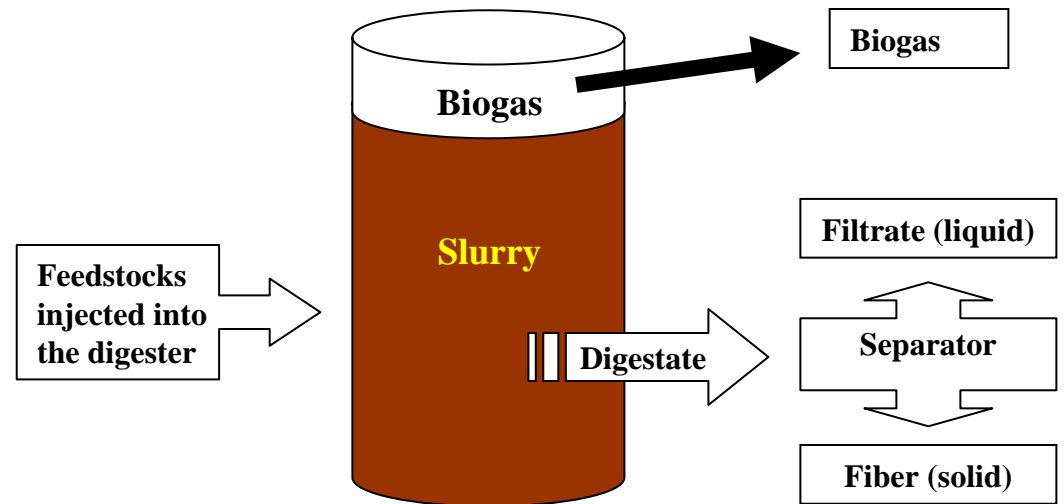
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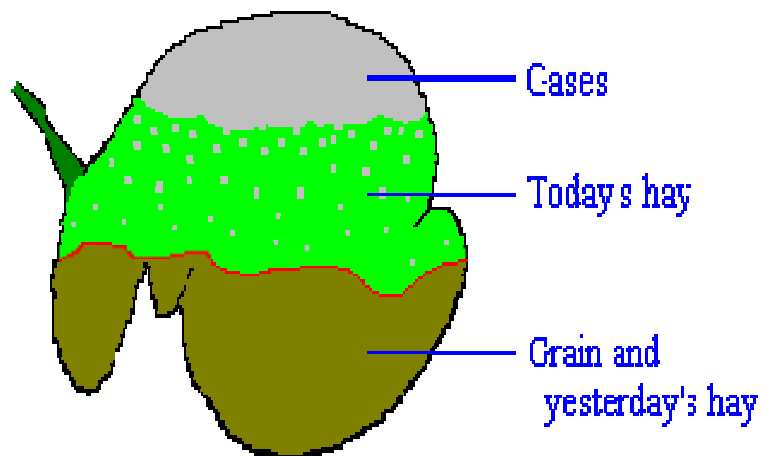


Human G.I. Tract

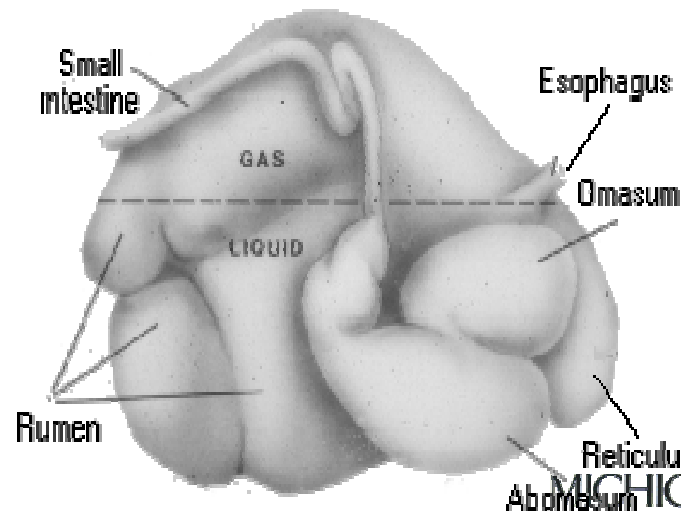
ADAM.



Basic Anaerobic Digestion Process



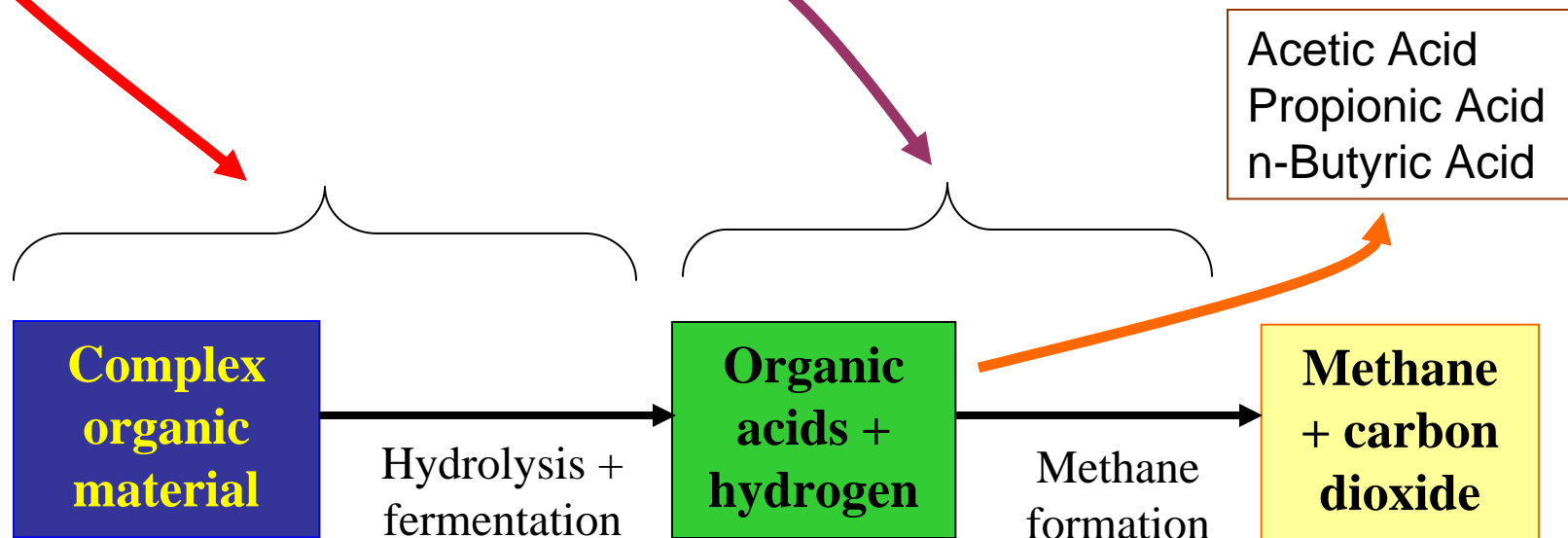
Ruminant animal digestive tract



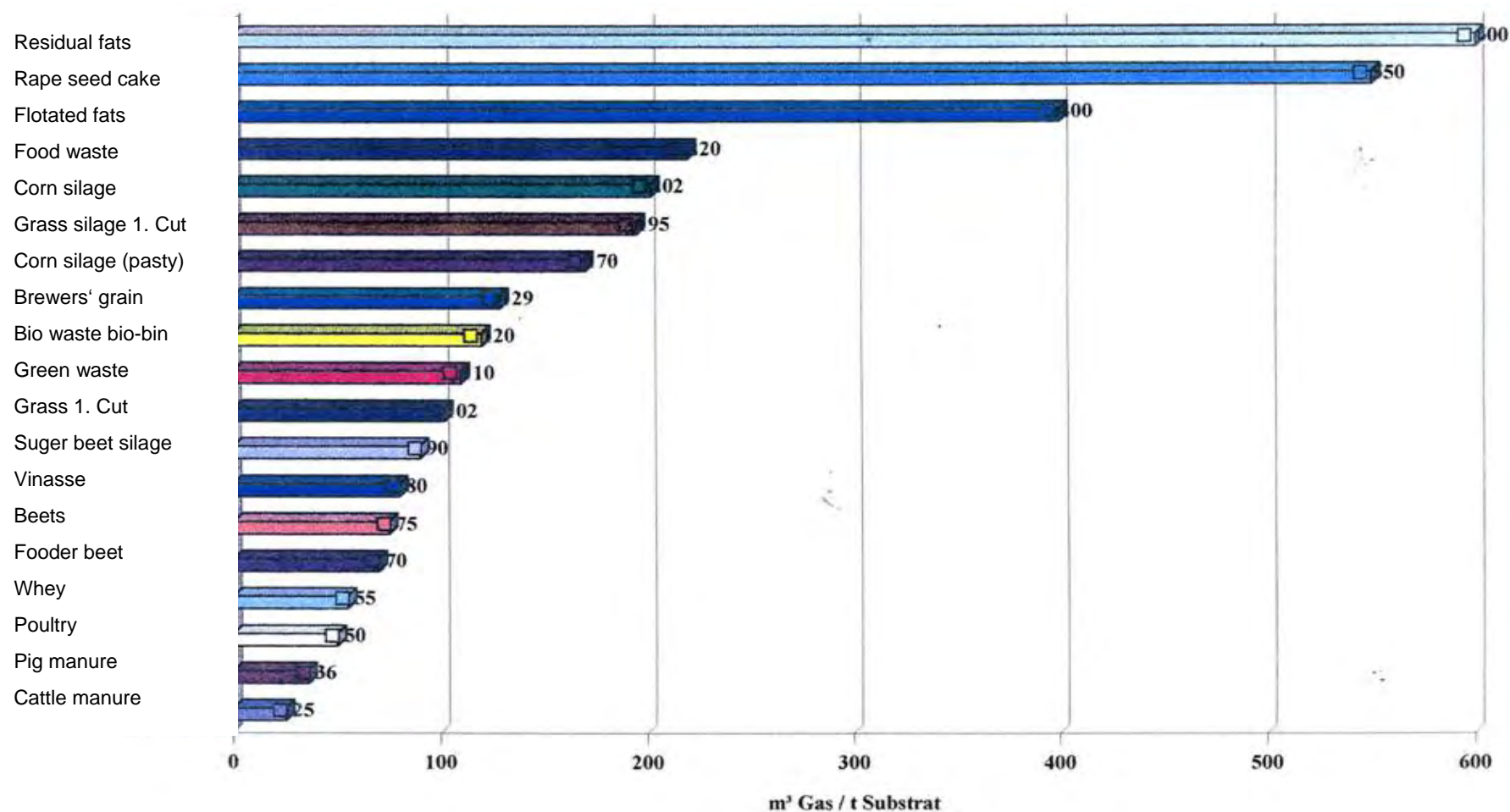
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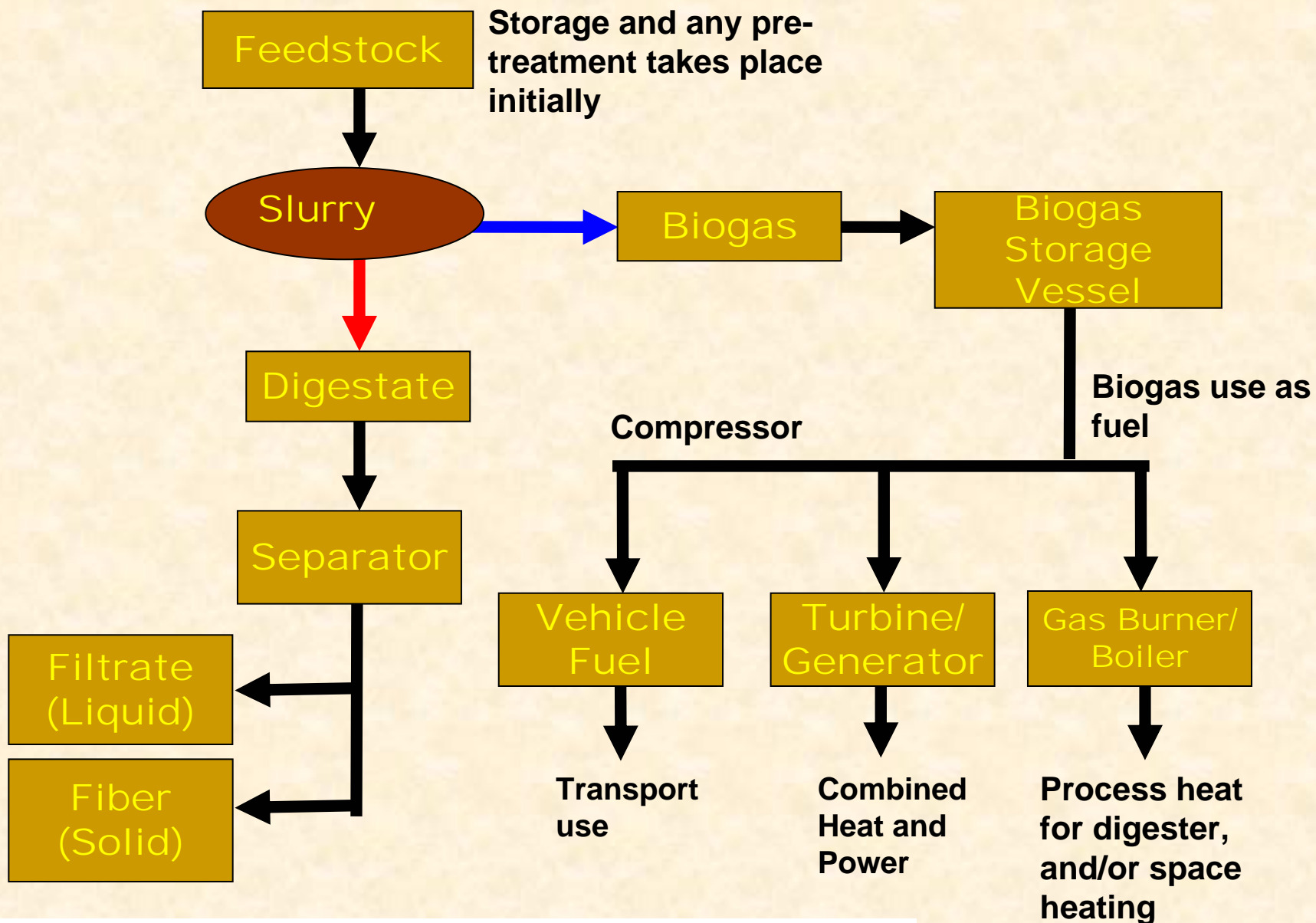
Biogas Production Simplified

- Bacteria ferment and convert complex organic materials into acetate and hydrogen, and then-
- Methanogens convert the acetate and hydrogen into methane.



Gas Yields of Different Feedstocks





3-1.1 Anaerobic Digester Process Flow Diagram with options.

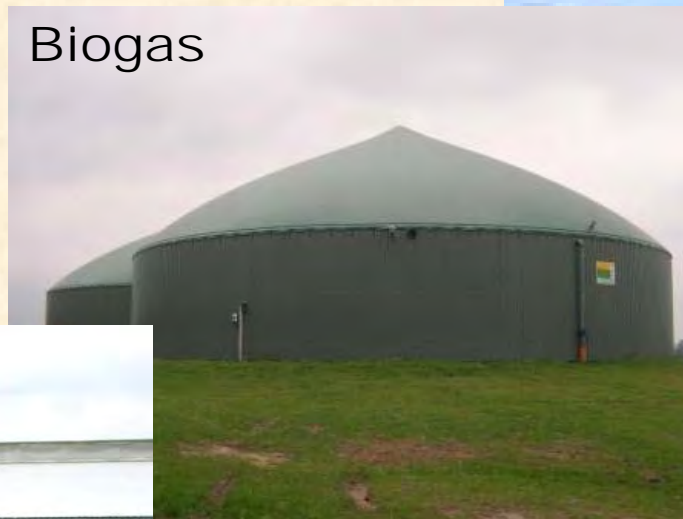
Adapted from: http://www.anaerobic-digestion.com/html/anaerobic_flow_diagram.html

Products from Anaerobic Digestion

Filtrate



Biogas



Solid Digestate or Fiber



Products from Anaerobic Digestion

- Liquids (filtrate)
 - Liquid fertilizer
- Solids (fiber)
 - Compost
 - Animal bedding
 - Pellet/Granule fertilizer
 - Fuel pellets
 - Medium density fiberboard and decking
- Biogas
 - Digester gas
 - Pipeline quality gas
 - Carbon dioxide
 - Ammonium-N
 - Hydrogen
- Fuel
 - Methanol
- Heat
- Steam

Plus spin off opportunities such as carbon credits, prawns, biodiesel, ethanol, specialty greenhouse crops...you are only limited by your imagination!

Michigan's Bioeconomy

- Use digesters as anchors for industry that are energy intensive. Be creative!!

Model 1

- Liquid: Grow high dollar crops in greenhouses hydroponically
- Solids: Make medium density fiberboard, pots for greenhouse industry, cubicle paneling.
- Biogas: Use in manufacturing process

Model 2

- Liquid: Grow high dollar crops in greenhouses hydroponically
- Solids: Make compost or grow mushrooms
- Biogas: Heat greenhouse with biogas. Clean up excess biogas to pipeline quality standards and sell.

Model 3

- Liquid: Grow algae for biodiesel plant
- Solid: Sell as cattle bedding
- Biogas: Use to operate biodiesel plant

Types of Digesters



Heated Fixed Film Digester. Photo courtesy of Biopower Technologies, Inc



Continuous Mix Plug Flow Digester at Gordondale Farms, Nelsonville, Wisconsin. Photo courtesy of GHD, Inc, Chilton, WI



Complete Mix Digester at Scenic View Dairy Fennville, MI. Photo courtesy of Charles Gould



Plug Flow Digester Haubenschild Dairy, Minnesota. Photo courtesy of Charles Gould

Thanks!